Title:	**Current LCS architecture in UMTS and standalone SMLC**
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Introduction

This document describes SMLC functionality in general terms and the reasoning behind the current LCS architecture in UMTS. It illustrates several benefits of integrating SMLC functionality in the Serving RNC and explains why the NSS based SMLC is not the best possible solution for UMTS. This document details the reasoning for a BSS based SMLC functionality in 3G and elaborates on the existing open LCS interfaces in the core network. SMLC functionality could be separated from SRNC in several ways and further study is needed to find the optimum solutions.

SMLC functionality in GSM

The main functions of the Serving Mobile Location Center, SMLC, are the following in GSM:
- Receive location requests from MSC and send corresponding location results back to MSC directly or via BSC in R'98 and R'99 circuit switched domain
- Handle and obtain measurement results from Location Measurement Units, LMU
- Obtain measurement results from the Target MS in E-OTD and A-GPS.
- Calculate the position of the Target MS using the obtained measurement results and possible other radio network information
- Handle ciphering of LCS assistance data for the LCS assistance data broadcast function

SMLC in GSM LCS Rel 98/99

In GSM LCS specifications the support for SMLC can be either NSS based or BSS based. The NSS based SMLC is connected to the MSC, and the BSS based SMLC is connected to the BSC. Probably both NSS based SMLC and BSS based SMLC can exist in parallel in one PLMN, but the practical implementation of such a network configuration may be demanding. Furthermore, an assumption in GSM LCS stage 2, recommends to standardize a similar open interface to the SMLC whether it is NSS or BSS based. This simplifies migration from an NSS to a BSS based location architecture and avoids two different types of SMLC. In addition, another assumption in GSM LCS stage 2, states to enable migration from an NSS based SMLC to BSS based SMLCs. Therefore, even GSM LCS stage 2 supports the trend toward utilizing a BSS based SMLC.

LCS architecture in UMTS release 1999

Figure 1 illustrates the the LCS architecture in UMTS release 1999, as specified in TS23.002 "Network architecture". The figure indicates that SMLC functionality of UTRAN is integrated in SRNC. It is also noted in the specification that the usage of CBC for LCS assistance data in UMTS is for further study.
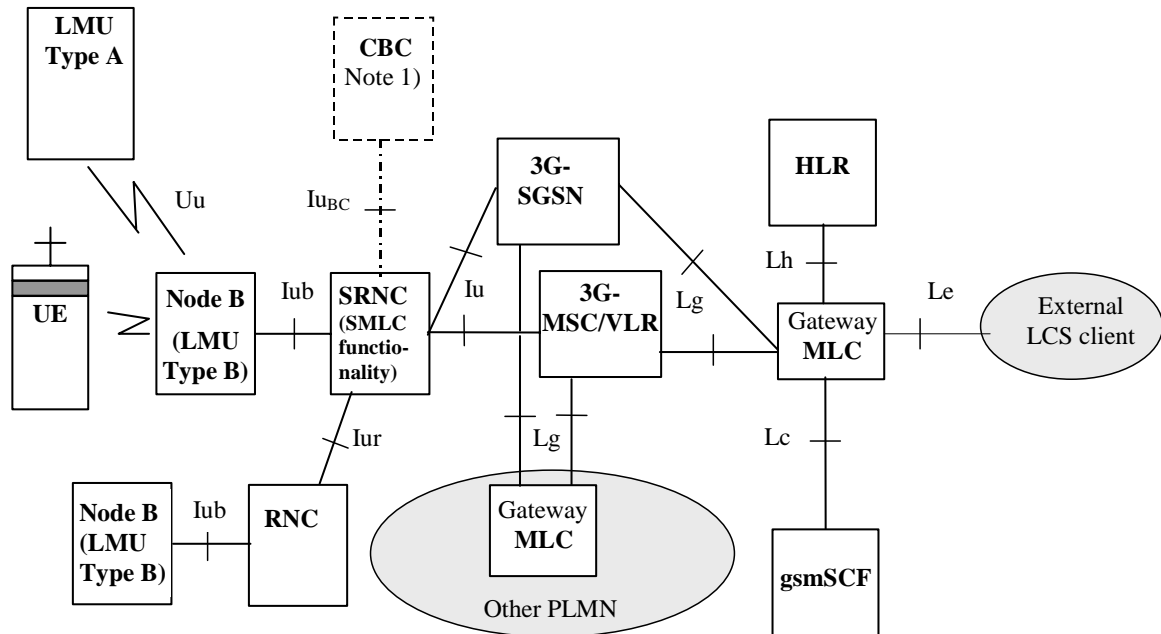
Figure 1: Configuration of LCS entities in a UMTS PLMN

SMLC functionality in UMTS

One main principle in 3GPP is to keep the radio network aspects purely in the access network specifications, and therefore it was not feasible to include NSS based SMLC in 3G specifications. Keeping the radio network separate from the core network is also one of the guiding principles when defining how to share the work between SA and RAN work groups. As illustrated in the SMLC functions list above, the tasks of SMLC are directly related to the radio access network. The Iu interface between the core network and the access network carries only the location requests and corresponding location reports.

Support for NSS based SMLC was necessary in GSM because LCS support was built on top of the existing GSM standard. The BSS based SMLC in GSM was introduced since heavy signaling loads on the A-interface with NSS based SMLC was anticipated. The signaling load on the Iu interface would also be substantial in 3G with a NSS based SMLC.

Furthermore, if NSS-SMLC is used only to generate and distribute assistance data for GPS, several such SMLCs are needed in a network, since the GPS assistance data is only valid over a few 100 kilometers. Broadcasting GPS assistance data is demanding for timing accuracy reasons. In UTRAN, assistance data is included in system information blocks. A cell broadcast center could in principle be used to broadcast GPS assistance data also in 3G systems, but normally CBC need not be involved at all. The RNC collects and calculates the assistance data and includes it in the system information to be broadcasted in the relevant cell. As an alternative, the RNC could transfer the cell related assistance data to the Cell Broadcasting Centre, which in turn would transfer the assistance data back to the RNC to be cell broadcasted… This complexity is the reason why the broadcasting of assistance data is stated "for further study" in the network architecture specification TS 23.002.

It was determined by 3GPP RAN WG2 and 3GPP SA WG2, that specifying one network element that may optionally be placed in either the access network or in the core network (or both) adds unnecessary system complexity, especially in the new 3G system. It is apparent that multiple options exist in the GSM LCS specifications, but these options have only added to the obscurity of the specifications and creates additional difficulties in implementation. Adding too many options to a specification reduces the simplicity and effectiveness of one complete standard.
The goal for LCS in UTRAN was, and still is, to optimize functionality and system architecture: it is easier from standardization and signaling point of view to integrate LCS functionality in RNC. RNC already has ready access to much of the information needed for location determination of a target MS.

A NSS based SMLC in UMTS would only increase system and standardisation complexity in 3G.

Open LCS interfaces in the core network

The Gateway Mobile Location Center, GMLC, is the gateway between the LCS Client and the mobile network. GMLC is connected over standardised interfaces to HLR (Lh interface), MSC (Lg interface),SGSN (Lg interface in Rel'4) and the Lc interface to Camel applications. The current understanding is that the Le interface between GMLC and the LCS client should be part of OSA (Open Services Access).
The Location Inter-operability Forum, LIF, is standardizing support for location services that is also applicable for the Le interface of GMLC.

The GMLC interfaces are the same for 2G and 3G and possible enhancements in Rel'4 and future releases are applicable for both 2G and 3G. Hence, there is evolutionary support of LCS interfaces provided in the core network.

Conclusion

The basic LCS architecture in 3G was introduced and accepted by 3GPP RAN WG2 and 3GPP SA WG2 /SMG12 early in 1999. The concept was also presented in the SMG-12 /T1P1 meeting in Sophia-Antipolis in May 1999. There were no objections in any of these groups to integrate the SMLC functionality in SRNC. No contributions proposed to keep the standalone mobile location center, SMLC, as a separate network entity in 3G. Reopening the discussion on basic architecture issues may jeopardize the whole Rel'4 standardization schedule.

It has now become evident that there is strong demand to reintroduce the open interfaces of LCS in GSM in 3G specifications. Open standardized interfaces are supported in 3G, however the arguments against the standalone SMLC in the core network are still valid:

- There should be no radio information in the core network
- There is a risk of high signaling load on the Iu interface, if the SMLC is in the core network
- Too many options will increase the system complexity and reduce the specification's significance.

The current 3G LCS specifications include SMLC functionality in the Serving RNC of the access network. The SRNC is the main signaling node in the UTRAN specifications and SRNC handles LCS signaling with the MSC /SGSN, LMUs, and target mobiles. It has been illustrated that a NSS based SMLC in UMTS would only increase system and standardisation complexity in 3G.

As a means forward, it should be studied what would the best way to separate the SMLC functionality from the SRNC, because this could be done in various ways. E.g. reintroducing 2G-Lb in UTRAN is not an optimal solution, and such an approach would risk the stability of the UTRAN core specifications.

Proposal

It is proposed to investigate if the standalone SMLC network entity could be introduced in connection with the proposed IP based distributed architecture of UTRAN in Rel' 5. SMLC could be introduced as a natural element of this distributed architecture, because SMLC requests regular reports from specific cell related LMUs. TSG RAN is organising a workshop on "UTRAN Evolution" and the corresponding proposed Work Item February 5-6, 2001 in Helsinki.